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(54) **ELECTRONIC DEVICE WITH HEAT SINK STRUCTURE**

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,115,252	A *	9/2000	Ohta et al.	361/700
7,660,119	B2 *	2/2010	Iikubo	361/697
7,688,587	B2 *	3/2010	Ishikawa	361/695
8,059,410	B2 *	11/2011	Chen et al.	361/719
8,102,649	B2 *	1/2012	Ma et al.	361/679.47
8,218,313	B2 *	7/2012	Cheng et al.	361/679.48

FOREIGN PATENT DOCUMENTS

TW	M265680	5/2005
TW	200712846 A *	4/2007
TW	M327130	2/2008
TW	200925835 A	6/2008
TW	I300894	9/2008

OTHER PUBLICATIONS

Taiwan Patent Office, Office Action, Patent Application Serial No. 101115082, Jul. 29, 2014, Taiwan.

* cited by examiner

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G06F 1/20 (2006.01)
H05K 1/02 (2006.01)
F28F 3/02 (2006.01)

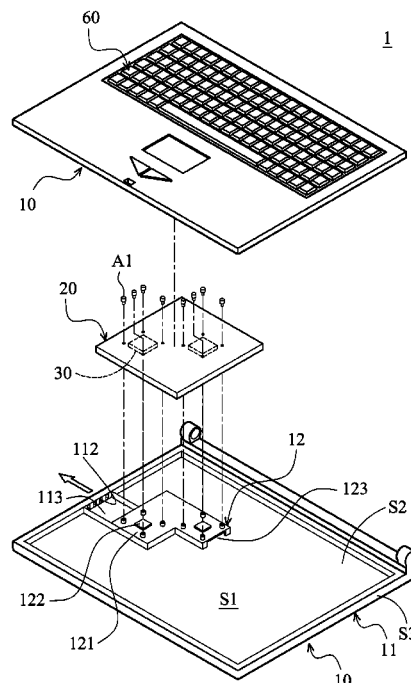
(52) **U.S. Cl.**
CPC **H05K 1/0203** (2013.01); **F28F 3/02** (2013.01); **G06F 1/203** (2013.01)

(58) **Field of Classification Search**
CPC G06F 1/20; G06F 1/203; G06F 1/206
USPC 361/679.49, 679.48, 679.5, 679.51; 454/239, 256, 257, 258, 370
See application file for complete search history.

(57) **ABSTRACT**

An electronic device includes a housing and a chip. The housing includes a main body and a supporting portion. The main body has an inner surface and an outer surface, and an opening disposed on the outer surface. The supporting portion is disposed on the inner surface, and has a heat dissipating chamber that communicates with the opening. The chip is disposed on the supporting portion, and the heat generated by the chip is transmitted via the housing.

21 Claims, 10 Drawing Sheets



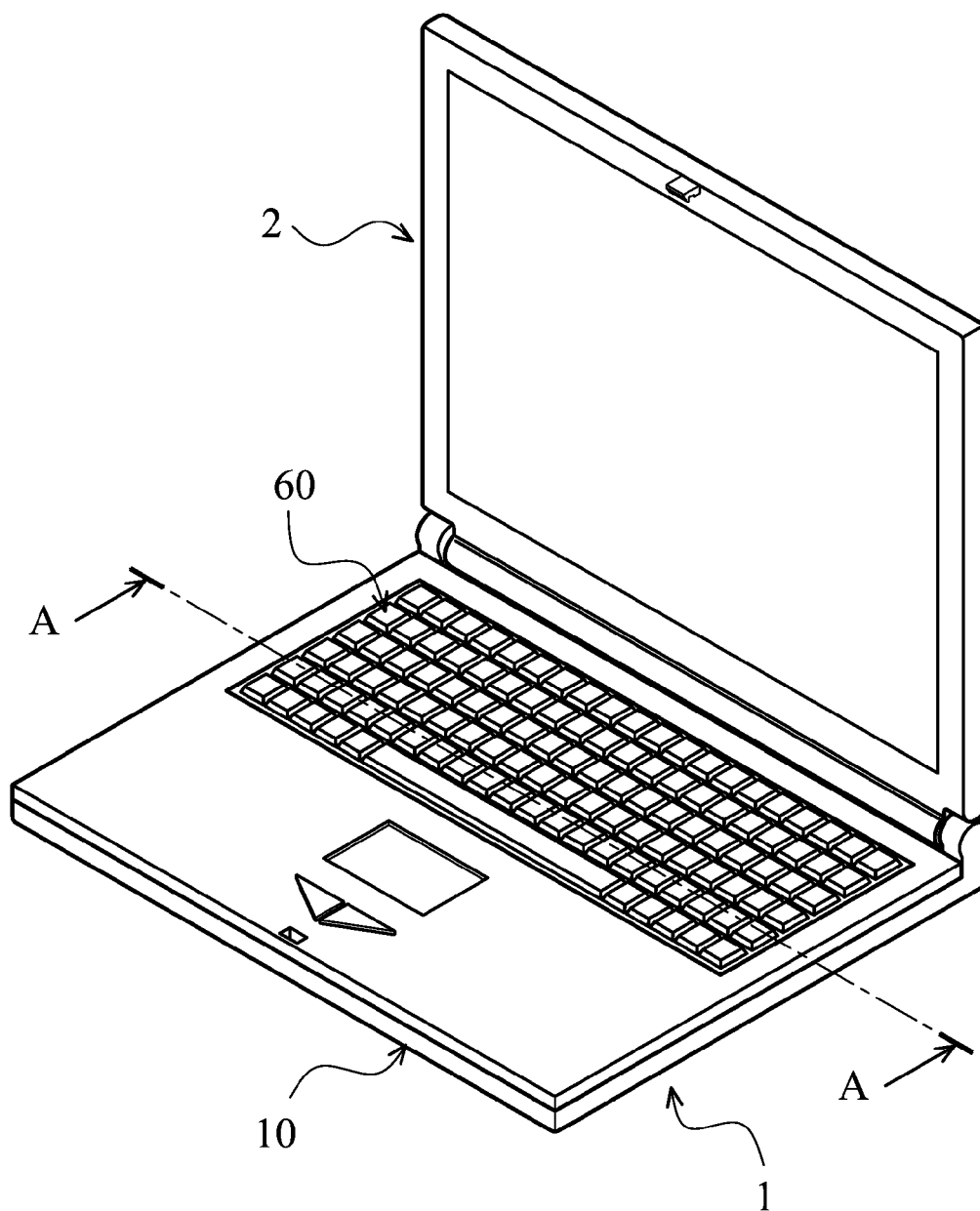
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FIG. 1

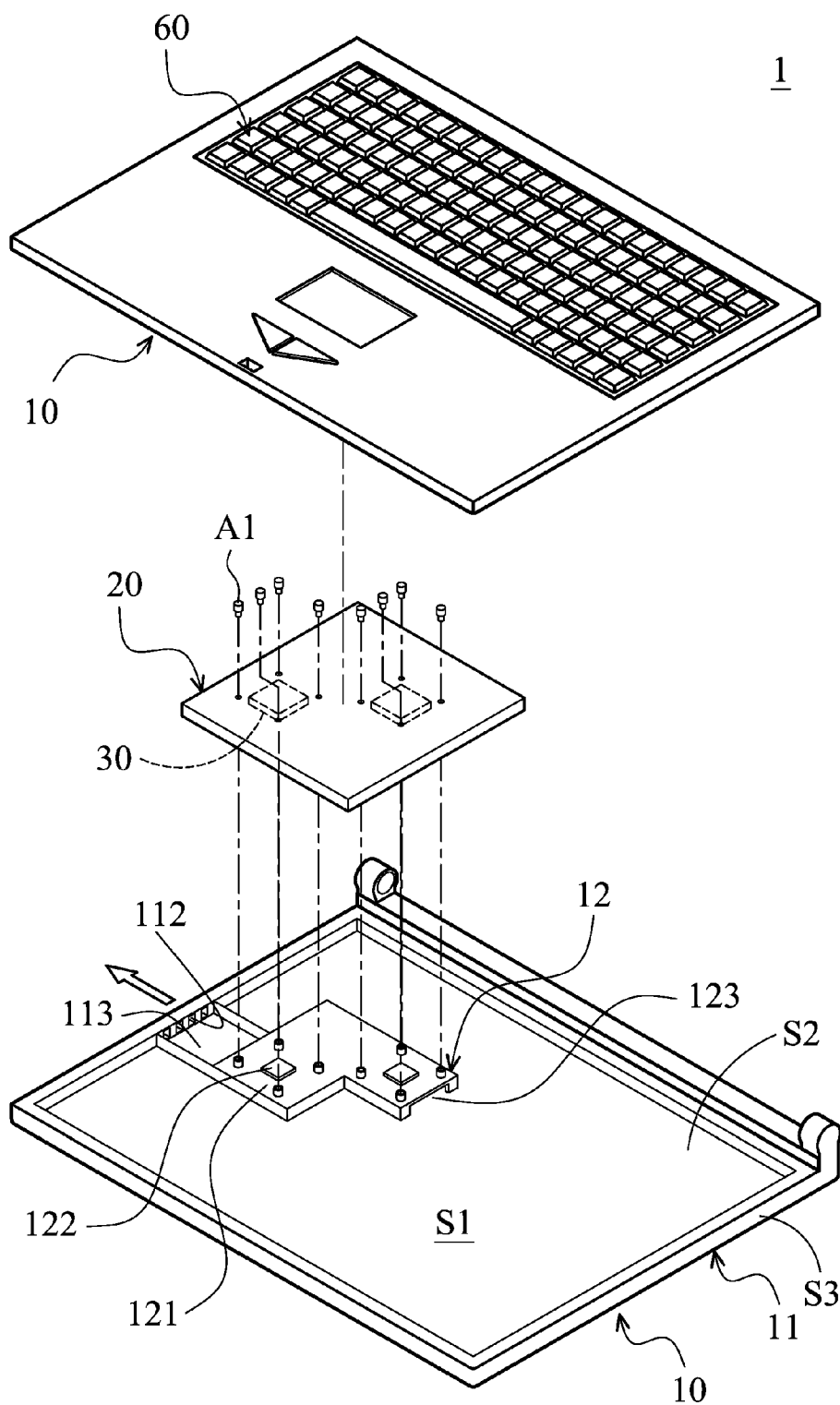


FIG. 2

1

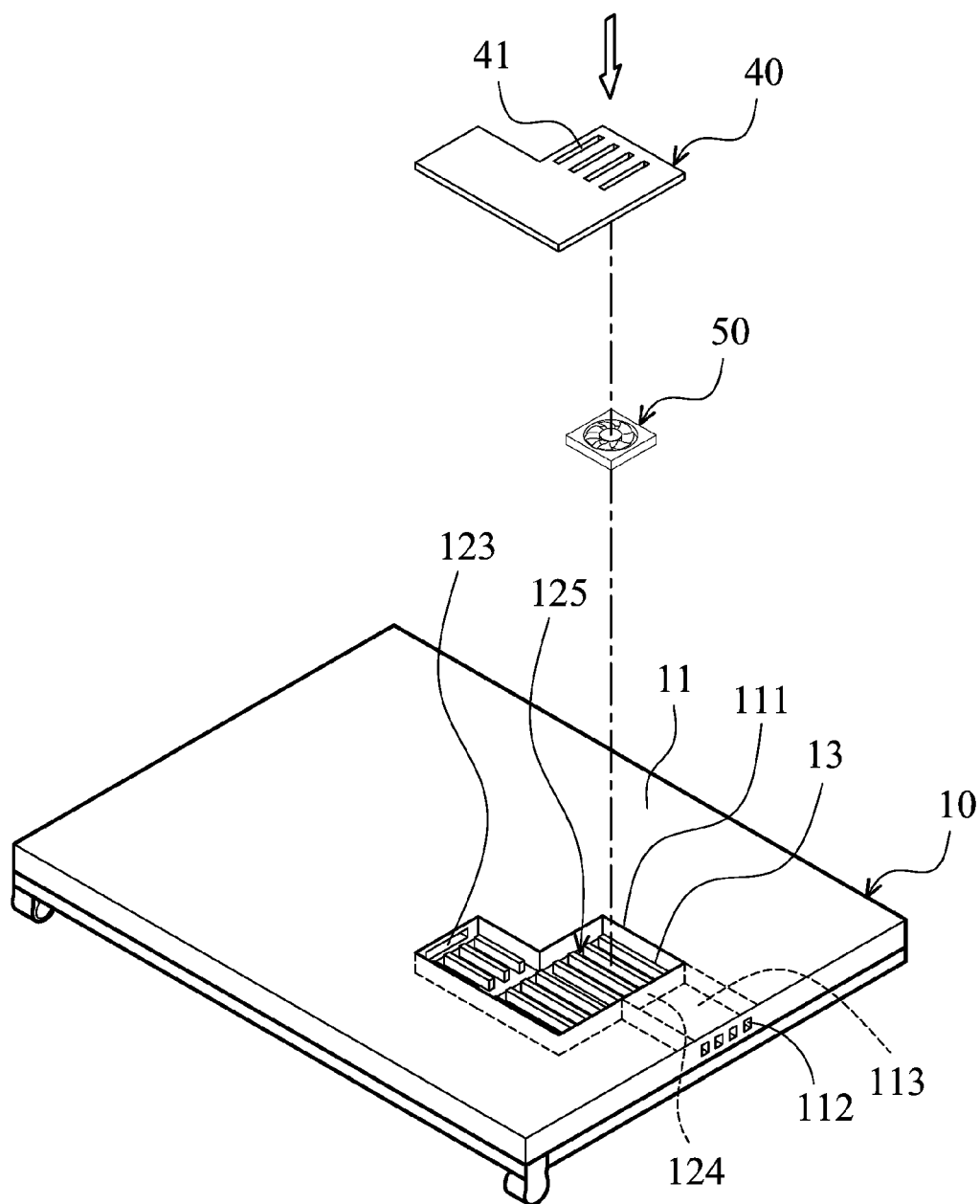


FIG. 3

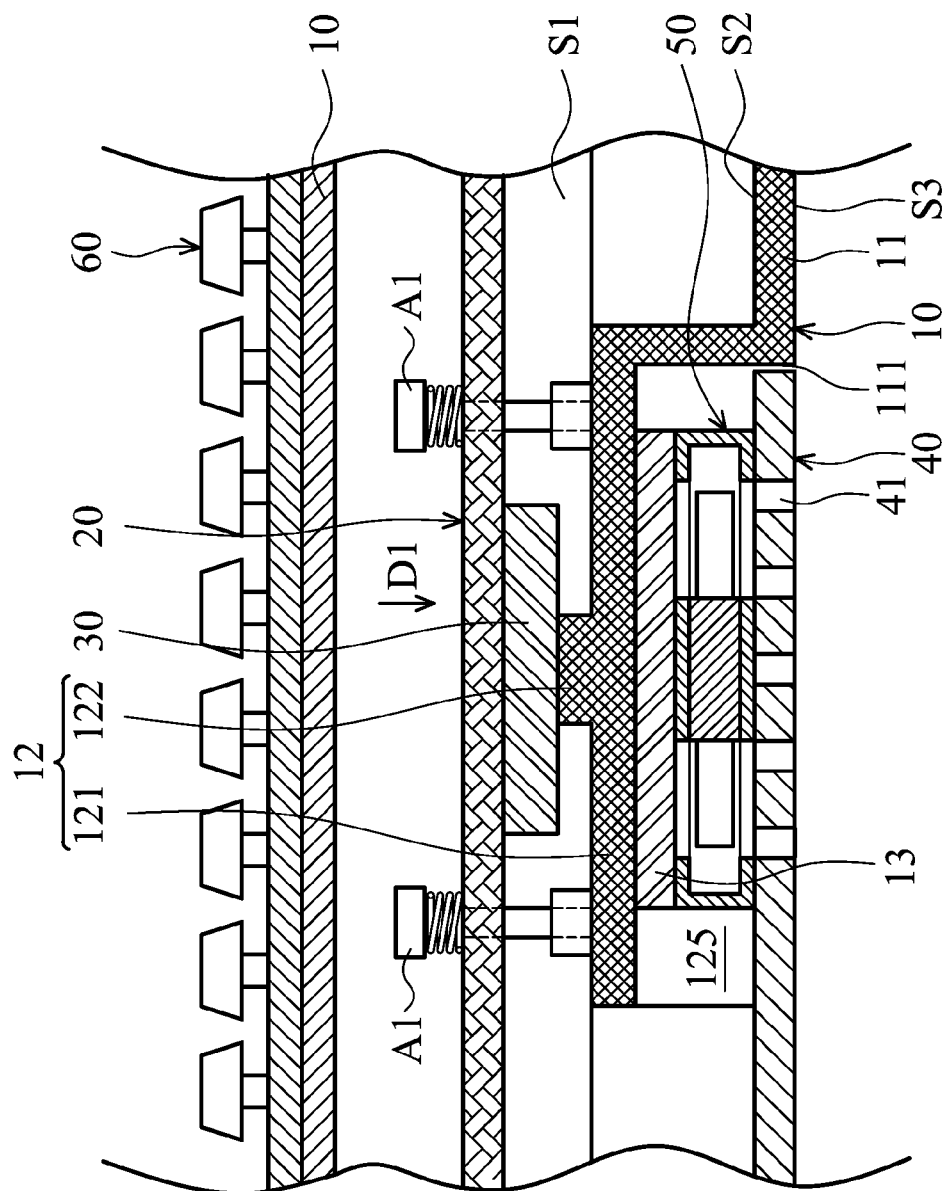


FIG. 4

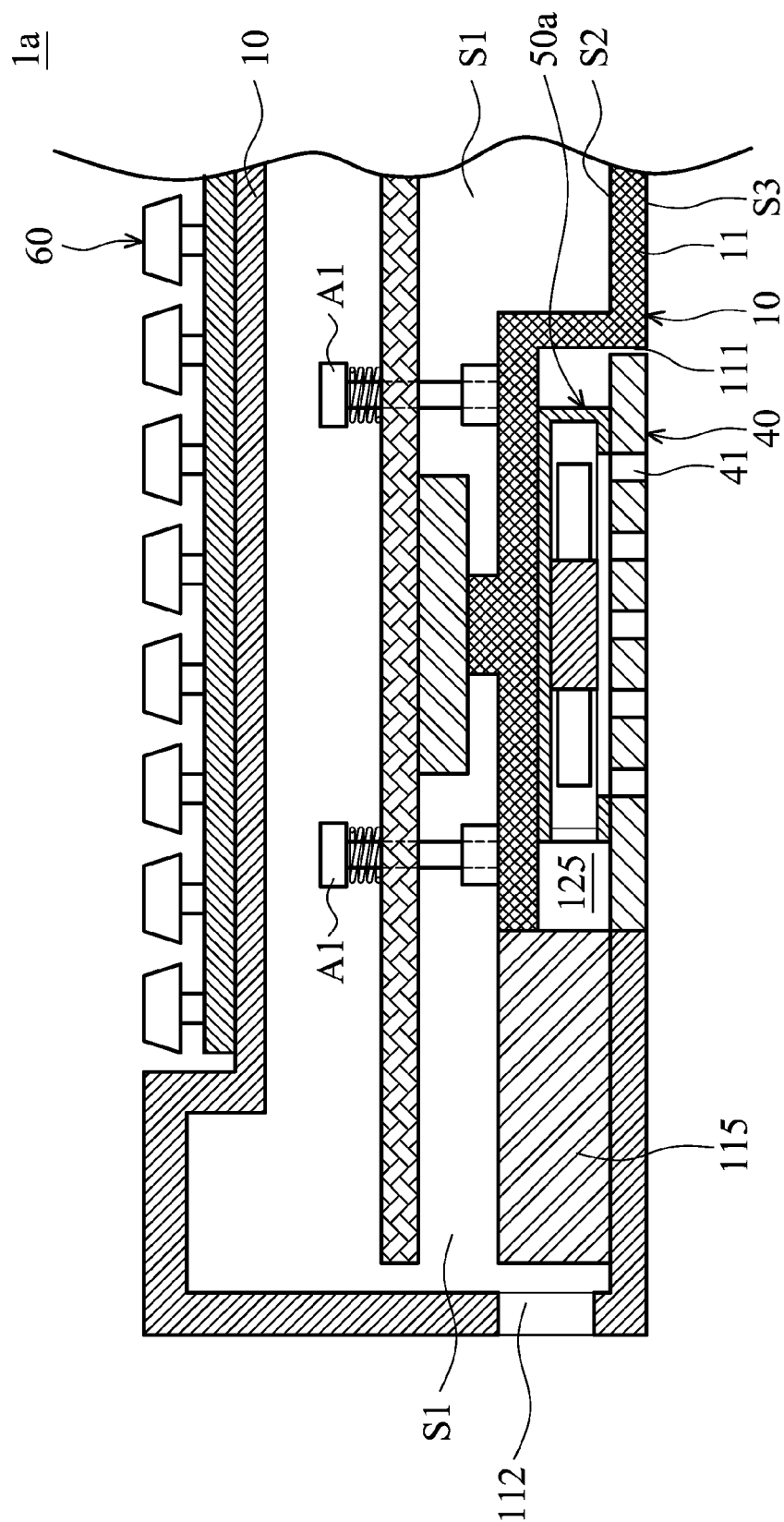


FIG. 5

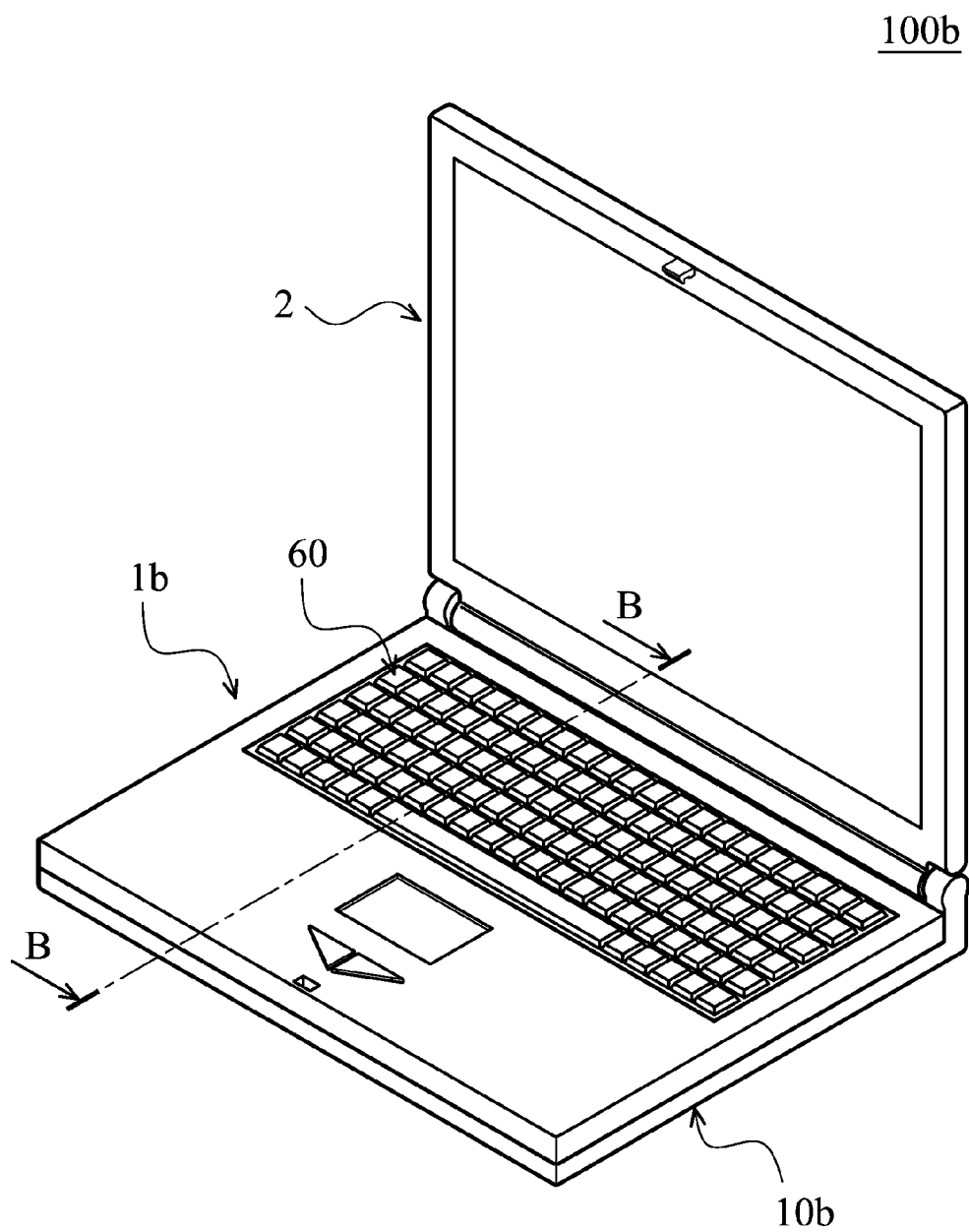


FIG. 6

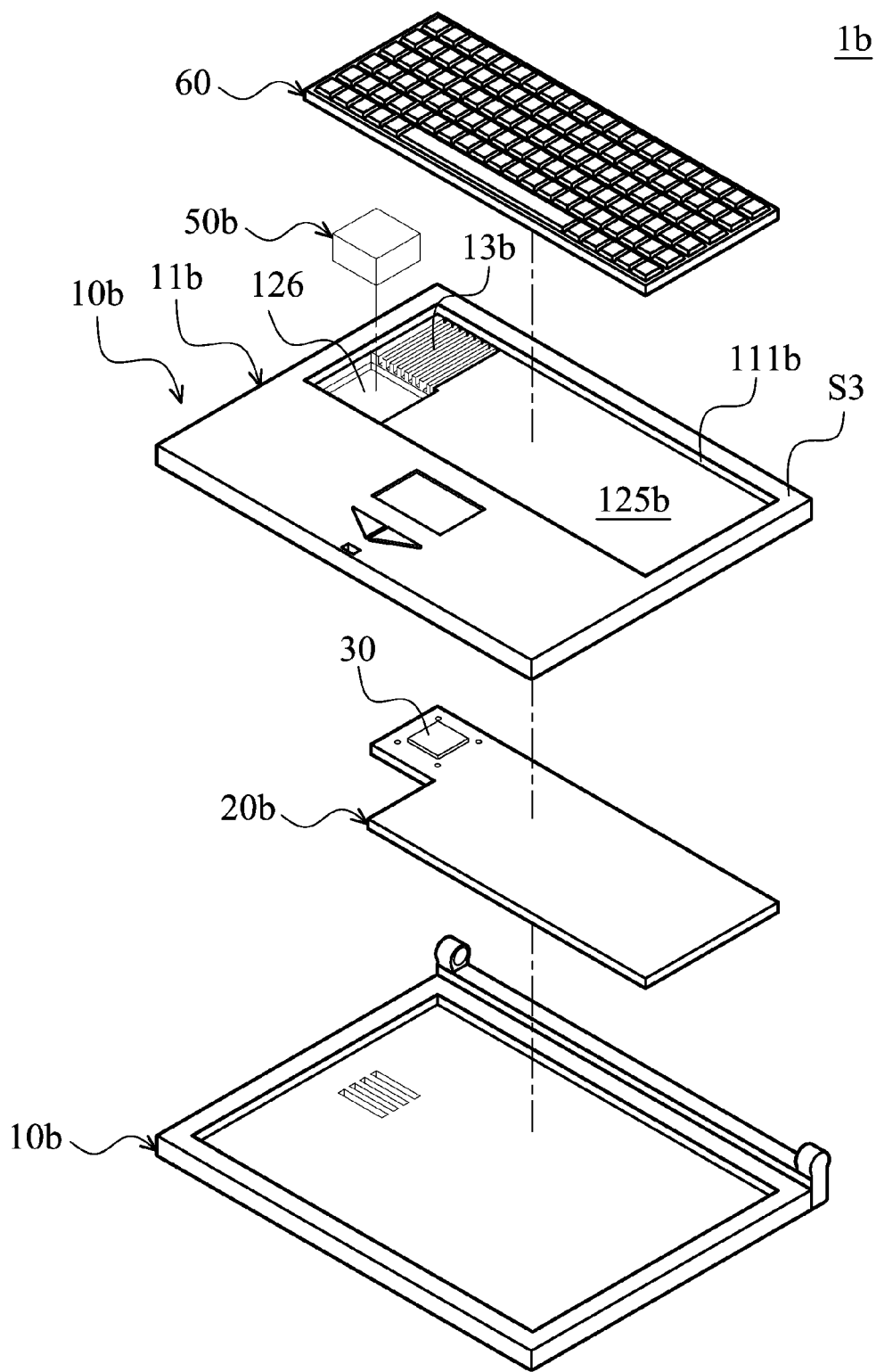


FIG. 7

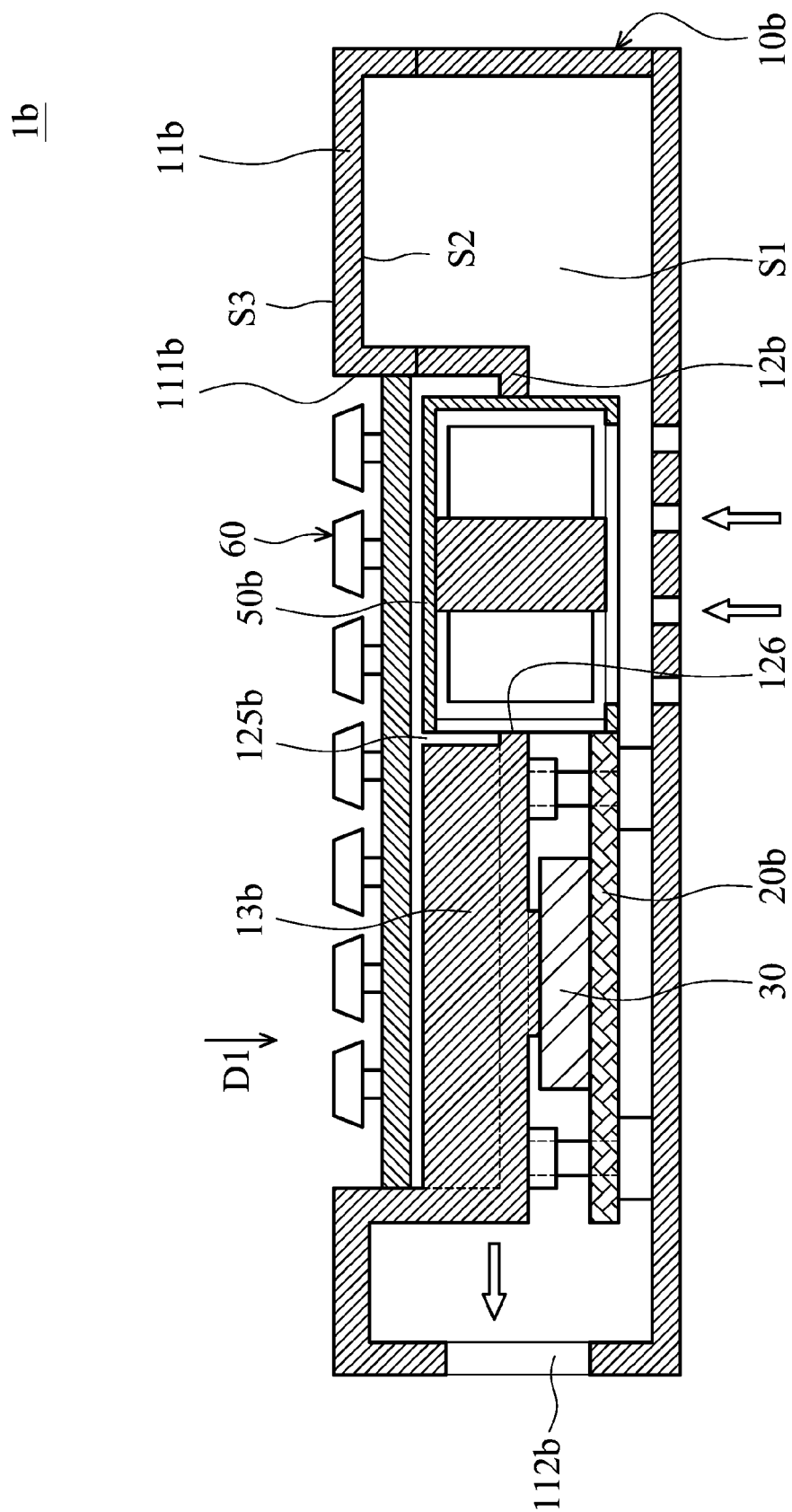


FIG. 8

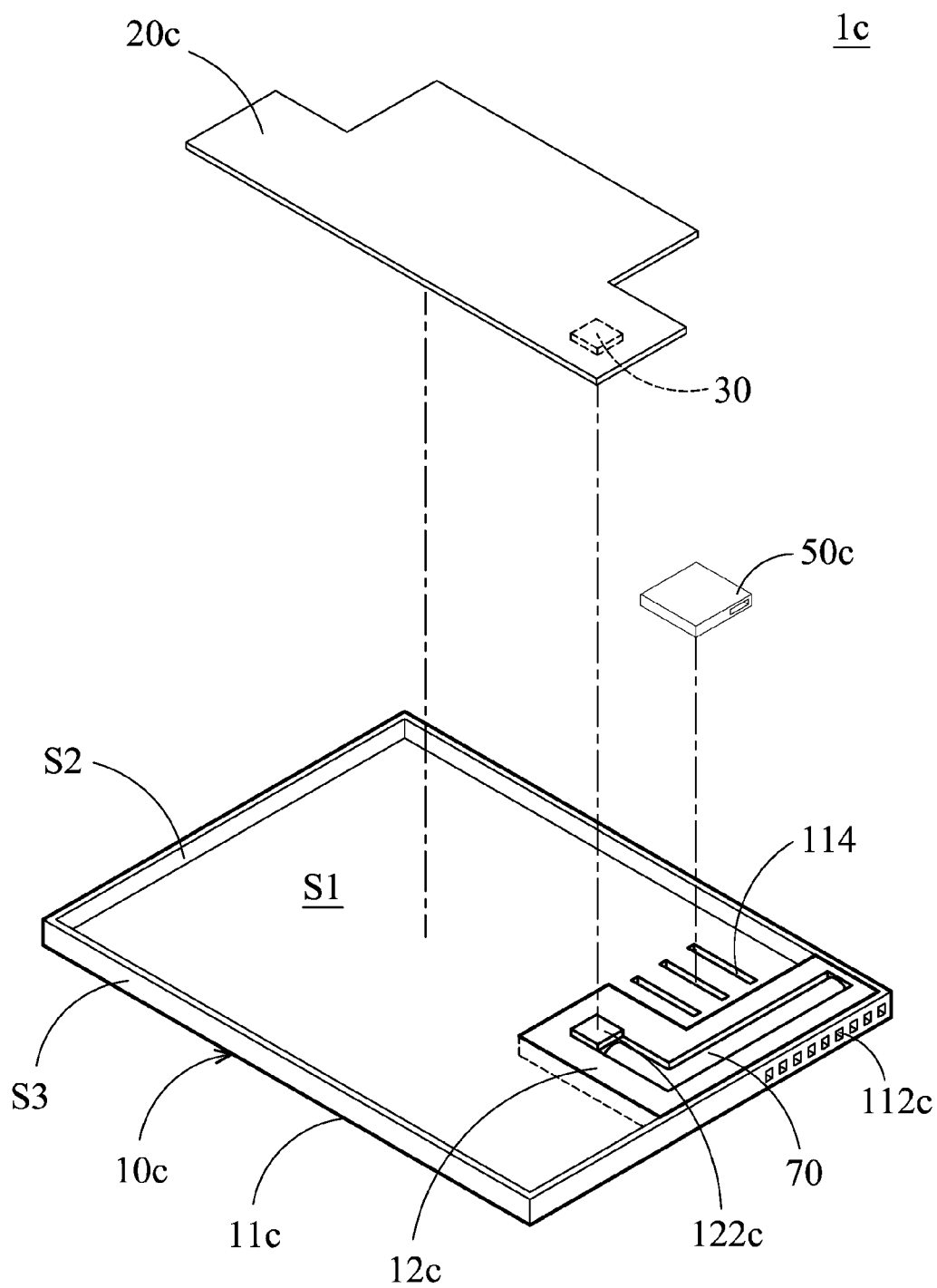


FIG. 9

1c

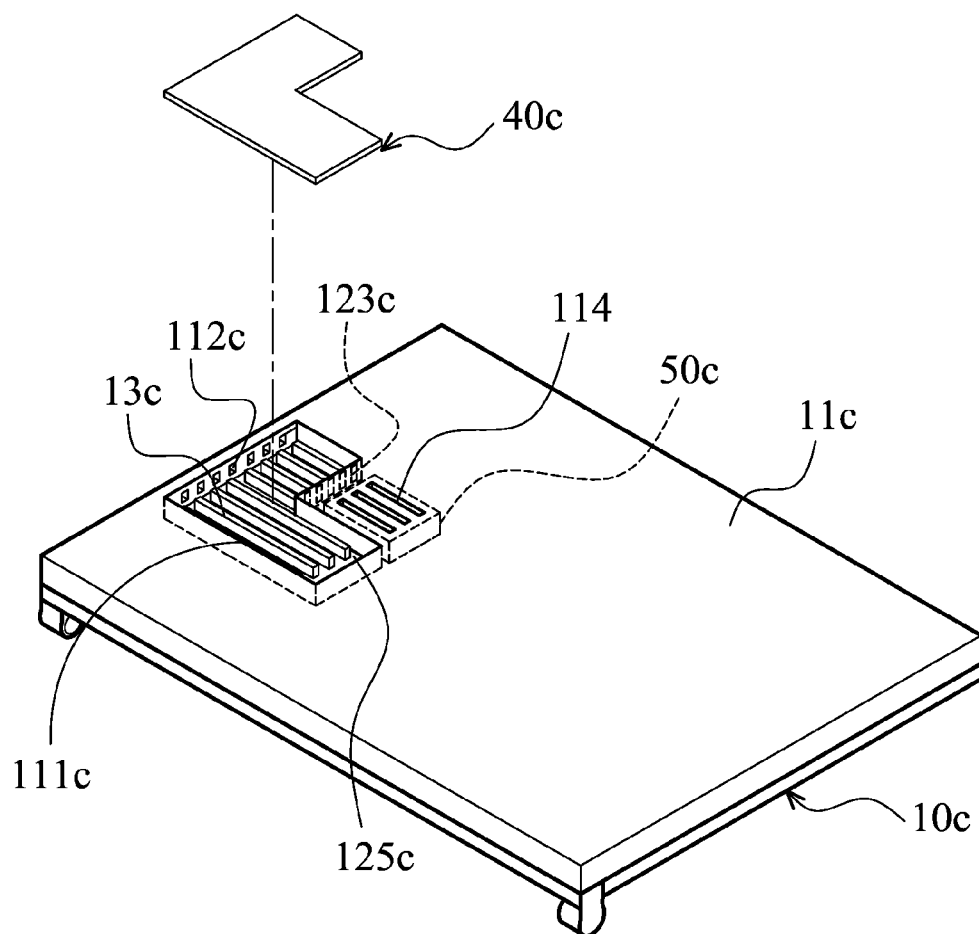


FIG. 10

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ELECTRONIC DEVICE WITH HEAT SINK STRUCTURE

CROSS-REFERENCE TO RELATED APPLICATIONS

This Application claims priority of Taiwan Patent Application No. 101115082, filed on Apr. 27, 2012, the entirety of which is incorporated by reference herein.

BACKGROUND

1. Field of the Invention

The disclosure relates to an electronic device, and in particular to an electronic device including a housing for dissipating heat.

2. Description of the Related Art

In general, the efficiency of the notebook computer is higher, and the heat generated by the notebook is higher. Thus, the notebook with high efficiency includes fans and heat sink fins therein to dissipate the heat. However, the process of installing the fans and the heat sink fins into the notebook is very complex. Further, the fans and the heat sink fins need to be redesigned to correspond to the different configurations of different notebooks. Thus, the design time and the difficulty of the design of the electronic device increase.

In addition, since the heat generated by a chip of the notebook is only transmitted by the heat sink fins, and the fan and the heat sink fins are disposed in the notebook, the heat dissipating efficiency of the notebook is low.

BRIEF SUMMARY OF THE INVENTION

To solve the problems of the prior art, the objective of the present disclosure is to simplify the assembly of the electronic device, to decrease the design time and the difficulty of design of the electronic device, and to increase the heat dissipating efficiency of the electronic device.

For the above objective, the present invention provides a heat sink structure including a housing. The housing includes a main body and a supporting portion. The main body has an inner surface, an outer surface, and an opening disposed on the outer surface. The inner surface forms a receiving space. The supporting portion is disposed on the inner surface, and is located in the receiving space. The supporting portion has a heat dissipating chamber that communicates with the opening.

For the above objective, the present disclosure provides an electronic device including a housing, a circuit board and a chip. The housing includes a main body, a supporting portion and a plurality of heat sink fins. The main body has an inner surface, an outer surface and an opening disposed on the outer surface. The inner surface forms a receiving space. The supporting portion is disposed on the inner surface, and is located in the receiving space. The supporting portion has a heat dissipating chamber that communicates with the opening. The heat sink fins are disposed on the supporting portion, and are located in the heat dissipating chamber. The circuit board is disposed in the receiving space. The chip is disposed on the circuit board, and connected to the supporting portion. The main body, the supporting portion and the heat sink fins are formed as a single piece.

For the above objective, the present disclosure further provides an electronic device including a housing, a fan and a chip. The housing includes a main body and a supporting portion. The main body has an inner surface, an outer surface

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and an opening disposed on the outer surface. The inner surface forms a receiving space. The supporting portion is disposed on the inner surface, and is located in the receiving space. The supporting portion has a heat dissipating chamber that communicates with the opening. The fan is disposed in the heat dissipating chamber. The chip is disposed on the supporting portion, and is located in the receiving space.

In conclusion, since the fan or the heat sink fins of the present disclosure are disposed on the outer side of the housing, and the chip is connected to the housing, the assembly of the electronic device is simplified and the design time and the difficulty of the design of the electronic device decrease. Further, the heat dissipating efficiency of the electronic device increases.

BRIEF DESCRIPTION OF THE DRAWINGS

The disclosure can be more fully understood by reading the subsequent detailed description and examples with references made to the accompanying drawings, wherein:

FIG. 1 is a perspective view of a first embodiment of an electronic device of the present disclosure;

FIGS. 2 and 3 are exploded views of the first embodiment of the base of the present disclosure;

FIG. 4 is a cross-sectional view of cross-sectional line A-A in FIG. 1;

FIG. 5 is a cross-sectional view of a second embodiment of the base of the present disclosure;

FIG. 6 is a perspective view of a third embodiment of an electronic device of the present disclosure;

FIG. 7 is an exploded view of the third embodiment of the base of the present disclosure;

FIG. 8 is a cross-sectional view of BB cross-sectional line of FIG. 6; and

FIGS. 9 and 10 are exploded views of a fourth embodiment of the base of the present disclosure.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 is a perspective view of a first embodiment of an electronic device 100 of the present disclosure. FIGS. 2 and 3 are exploded views of the first embodiment of the base 1 of the present disclosure. FIG. 4 is a cross-sectional view of cross-sectional line A-A in FIG. 1. As shown in FIG. 1, the electronic device 100 may be a notebook computer. The electronic device 100 includes a base 1 and a display 2. The display 2 pivots on the base 1.

As shown in FIGS. 2 and 3, the base 1 includes a housing 10, a circuit board 20, a chip 30, a blocking plate 40, a fan 50 and a keyboard module 60. The housing 10 is made from alumina or an aluminum alloy. The housing 10 includes a main body 11, a supporting portion 12 and a plurality of heat sink fins 13 formed by stamping. In the embodiment, the elements, such as the main body 11, the supporting portion 12, the heat sink fins 13, and the fan 50, may be formed as a heat sink structure, and the main body 11, the supporting portion 12, and the heat sink fins 13 may be formed as a single piece to simplify the assembly process.

The main body 11 has a receiving space S1, an inner surface S2, an outer surface S3, an opening 111, a dissipating hole 112 and a flow channel 113. The receiving space S1 is located in the main body 11. The inner surface S2 is also located in the main body 11 and forms the receiving space S1. The opening 111 is disposed on the outer surface S3, and is located on the bottom of the main body 11. The dissipating hole 112 passes through the main body 11, and communicates with the flow channel 113.

The supporting portion **12** is disposed on the inner surface **S2** of the main body **11**, and is located in the receiving space **S1**. The supporting portion **12** includes a protrusion body **121**, a heat conduction bump **122**, an inlet hole **123**, an outlet hole **124** and a heat dissipating chamber **125**. The heat conduction bump **122** is disposed on the top of the protrusion body **121**, and corresponds to the chip **30**. The inlet hole **123** and the outlet hole **124** are respectively disposed on the sidewall of the protrusion body **121**. The receiving space **S1** communicates with the inlet hole **123**. The heat dissipating chamber **125** communicates with the opening **111** of the main body **11**, and communicates with the inlet hole **123** and the outlet hole **124**. The flow channel **113** communicates with the outlet hole **124** and the dissipating hole **112**.

The heat sink fins **13** are a plate structure, separately disposed on the supporting portion **12**, and located in the heat dissipating chamber **125**.

The circuit board **20** may be a main board disposed in the receiving space **S1**. The chip **30** may be a central processing chip **30** or a display chip **30** disposed on the circuit board **20**, and located in the receiving space **S1**. The circuit board **20** may be fastened on the supporting portion **12** via locking elements **A1**, such as screws. When the circuit board **20** is disposed on the supporting portion **12**, the chip **30** is connected to the heat conduction bump **122** of the supporting portion **12**. Therefore, the heat generated by the chip **30** is transmitted to the entire housing **10** and the heat sink fins **13**, and the heat dissipating efficiency of the electronic device **100** increases. Moreover, the heat conduction bump **122** may accurately contact the chip **30** by adjusting the height of the heat conduction bump **122**.

In the embodiment, since the chip **30** and the heat sink fins **13** are located at two opposite sides of the supporting portion **12**, the path of the heat generated by the chip **30** and transmitted to the heat sink fins **13** is shorter. Moreover, the circuit board **20**, the chip **30**, the heat conduction bump **122**, the protrusion body **121**, the heat sink fins **13**, and the fan **50** are stacked along a stacking direction **D1** in sequence, and the heat dissipating efficiency increases.

The blocking plate **40** is disposed on the bottom of the main body **11** and covers the opening **111**. The blocking plate **40** has a plurality of open holes **41** corresponding to the fan **50**. The fan **50** may be an axial flow fan or a centrifugal fan. The fan **50** is disposed on a side of the heat sink fins **13**, and is located in the heat dissipating chamber **125**. The keyboard module **60** is disposed on the top of the main body **11**.

In the embodiment, the fan **50** is an axial flow fan. The fan **50** is directly disposed on the top of the heat sink fins **13**. When the fan **50** rotates, the fan **50** draws air from open holes **41**, and generates air flow directly to the heat sink fins **13**. Thus, the air flow with the heat of the heat sink fins **13** flows through the flow channel **113** and the outlet hole **124** to the dissipating hole **112**, and is exhausted through the dissipating hole **112**. Further, since the fan **50** and the heat sink fins **13** are located in the heat dissipating chamber **125**, the heat dissipating efficiency of the electronic device **100** increases.

In another embodiment, the heat generated by the chip **30** is lower, and the fan **50** (and the blocking plate **40**) may be omitted. The heat of the heat sink fins **13** is dissipated by the heat dissipating chamber **125**. In another embodiment, the heat sink fins **13** are omitted, and the fan **50** is disposed in the heat dissipating chamber **125**.

FIG. **5** is a cross-sectional view of a second embodiment of the base **1a** of the present disclosure. The main differences between the first embodiment and the second embodiment are described as follows. The heat sink fins **115** are disposed on the main body **11**, and located in the flow channel **113** of the

receiving space **S1**, and as a side of a fan **50a**. The heat sink fins **115** and the main body **11** are formed as a single piece. Moreover, the fan **50a** is a centrifugal fan. The fan **50a** is disposed on the supporting portion **12**, and located in the heat dissipating chamber **125** to decrease the thickness of the base **1a**.

FIG. **6** is a perspective view of a third embodiment of an electronic device **100b** of the present disclosure. FIG. **7** is an exploded view of the third embodiment of the base **1b** of the present disclosure. FIG. **8** is a cross-sectional view of BB cross-sectional line of FIG. **6**. The main differences between the first embodiment and the third embodiment are described as follows. A supporting portion **12b** is disposed on an inner surface **S2** of the main body **11b** of a housing **10b**, and located in the receiving space **S1**. An opening **111b** is located on the top of the main body **11b**. Heat sink fins **13b** are disposed on the supporting portion **12b**, and are located in the heat dissipating chamber **125b**. The chip **30** and the heat sink fins **13b** are located at two opposite sides of the supporting portion **12b**. The fan **50b** is located in the heat dissipating chamber **125b**, and disposed on a side of the heat sink fins **13b**. In the embodiment, the fan **50b** is a centrifugal fan near the sidewall of the heat sink fins **13b**. The supporting portion **12b** has a through hole **126** corresponding to the fan **50b**.

The keyboard module **60** is disposed in the heat dissipating chamber **125b**, and covers the heat sink fins **13b** and the fan **50b**. In the embodiment, the keyboard module **60**, the heat sink fins **13b**, the supporting portion **12b**, the chip **30**, and the circuit board **20b** are stacked along the stacking direction **D1** in sequence to decrease the thickness of the base **1b**.

When the fan **50b** rotates, the fan **50b** draws the air in the receiving space **S1** from the through hole **126** and generates air flow to the heat sink fins **13b** to exhaust the heat of the heat sink fins **13b** via the dissipating hole **112b**.

FIGS. **9** and **10** are exploded views of a fourth embodiment of the base **1c** of the present disclosure. The main differences between the first embodiment and the fourth embodiment are described as follows. A fan **50c** is a centrifugal fan disposed on a side of a heat sink fins **13c**, and located in the receiving space **S1**. A main body **11c** has a plurality of vent holes **114** corresponding to the fan **50c**. The heat dissipating chamber **125c** is located on the bottom of the main body **11c** of the housing **10c** and communicates with dissipating holes **112c**. The heat sink fins **13c** are disposed on the supporting portion **12c** and located in the heat dissipating chamber **125c**.

The base **1c** further includes a heat pipe **70** disposed on the supporting portion **12c**. An end of the heat pipe **70** is close to a heat conduction bump **122c** and a chip **30** of the circuit board **20c**, and the other end of the heat pipe **70** is close to the dissipating holes **112c** and the fan **50c**. The chip **30** is disposed on the heat conduction bump **122c**. By the heat pipe **70** of the embodiment, the position of the chip **30** may not be limited.

When the fan **50c** rotates, the fan **50c** generates air flow to the heat sink fins **13c** in the heat dissipating chamber **125c** via inlet holes **123c**, and the air flow with the heat of the heat sink fins **13c** is exhausted through the dissipating hole **112c**.

In conclusion, since the fan or the heat sink fins of the present disclosure are disposed on the outer side of the housing, and the chip is connected to the housing, the assembly of the electronic device is simplified and the design time and the difficulty of the design of the electronic device are decreased. Further, the heat dissipating efficiency of the electronic device is increased.

While the disclosure has been described by way of example and in terms of preferred embodiment, it is to be understood that the disclosure is not limited thereto. On the contrary, it is

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intended to cover various modifications and similar arrangements (as would be apparent to those skilled in the art). Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.

What is claimed is:

1. An electronic device, comprising:
a housing, comprising:
 - a main body having an inner surface, an outer surface, and an opening disposed on the outer surface, wherein the inner surface forms a receiving space;
 - a supporting portion, disposed on the inner surface and located in the receiving space, wherein the supporting portion has a heat dissipating chamber that communicates with the opening; and
 - a plurality of heat sink fins, disposed on the supporting portion and located in the heat dissipating chamber;
 - a keyboard module, disposed in the heat dissipating chamber and covering the heat sink fins; and
 - a chip, disposed on the supporting portion and located in the receiving space,
- wherein the chip and the heat sink fins are located at two opposite sides of the supporting portion, and the keyboard module, the heat sink fins, the supporting portion, and the chip are stacked along a stacking direction in sequence.
2. The heat sink structure as claimed in claim 1, wherein the main body and the supporting portion are formed as a single piece.
 3. The heat sink structure as claimed in claim 1, wherein the heat sink fins and the supporting portion are formed as a single piece.
 4. The heat sink structure as claimed in claim 3, further comprising a fan, disposed on a side of the heat sink fins and located in the heat dissipating chamber.
 5. The heat sink structure as claimed in claim 3, further comprising a fan, disposed on a side of the heat sink fins and located in the receiving space.
 6. The heat sink structure as claimed in claim 1, further comprising a fan disposed in the heat dissipating chamber.
 7. The heat sink structure as claimed in claim 1, further comprising a heat pipe disposed on the supporting portion.
 8. The heat sink structure as claimed in claim 1, further comprising a blocking plate covering the opening.
 9. An electronic device, comprising:
 - a housing, comprising:
 - a main body having an inner surface, an outer surface and an opening disposed on the outer surface, wherein the inner surface forms a receiving space;
 - a supporting portion, disposed on the inner surface and located in the receiving space, wherein the supporting portion has a heat dissipating chamber that communicates with the opening; and
 - a plurality of heat sink fins, disposed on the supporting portion and located in the heat dissipating chamber;
 - a keyboard module, disposed in the heat dissipating chamber and covering the heat sink fins;

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- a circuit board disposed in the receiving space; and
 - a chip, disposed on the circuit board and connected to the supporting portion,
- wherein the chip and the heat sink fins are located at two opposite sides of the supporting portion, and the keyboard module, the heat sink fins, the supporting portion, and the chip are stacked along a stacking direction in sequence.
10. The electronic device as claimed in claim 9, wherein the main body and the supporting portion are formed as a single piece.
 11. The electronic device as claimed in claim 9, wherein the heat sink fins and the supporting portion are formed as a single piece.
 12. The electronic device as claimed in claim 9, further comprising a fan, disposed on a side of the heat sink fins and located in the heat dissipating chamber.
 13. The electronic device as claimed in claim 9, further comprising a fan, disposed on a side of the heat sink fins and located in the receiving space.
 14. The electronic device as claimed in claim 9, further comprising a heat pipe disposed on the supporting portion.
 15. The electronic device as claimed in claim 9, further comprising a blocking plate covering the opening.
 16. An electronic device, comprising:
 - a housing, comprising:
 - a main body having an inner surface, an outer surface and an opening disposed on the outer surface, wherein the inner surface forms a receiving space; and
 - a supporting portion, disposed on the inner surface and located in the receiving space, wherein the supporting portion has a heat dissipating chamber that communicates with the opening, and has a through hole;
 - a fan, disposed in the through hole and located in the heat dissipating chamber and the receiving space; and
 - a keyboard module, disposed in the heat dissipating chamber and covering the fan;
 - a chip, disposed on the supporting portion, located in the receiving space,

wherein the chip and the keyboard module are located at two opposite sides of the supporting portion.

 17. The electronic device as claimed in claim 16, wherein the supporting portion and the main body are formed as a single piece.
 18. The electronic device as claimed in claim 16, wherein the housing comprises a plurality of heat sink fins disposed on the main body and located in the receiving space at a side of the fan, wherein the heat sink fins and the main body are formed as a single piece.
 19. The electronic device as claimed in claim 16, further comprising a heat pipe disposed on the supporting portion.
 20. The electronic device as claimed in claim 16, further comprising a blocking plate covering the opening.
 21. The electronic device as claimed in claim 16, further comprising a circuit board disposed on the chip, located in the receiving space.

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